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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/017,734	12/18/2001	Baowei Kang	B784.312-1	8852

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EXAMINER

NGUYEN, KHIEM D

ART UNIT PAPER NUMBER

2823

DATE MAILED: 09/25/2002

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/017,734

Applicant(s)

KANG ET AL.

Examiner

Khien D Nguyen

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☐ Responsive to communication(s) filed on ____.
- 2a) ☐ This action is FINAL. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-7 is/are pending in the application.
- 4a) Of the above claim(s) 1 is/are withdrawn from consideration.
- 5) ☐ Claim(s) ____ is/are allowed.
- 6) ☒ Claim(s) 2-7 is/are rejected.
- 7) ☐ Claim(s) ____ is/are objected to.
- 8) ☐ Claim(s) ____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 18 December 2001 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on ____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. ____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
* See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892) 4) ☐ Interview Summary (PTO-413) Paper No(s). ____.
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948) 5) ☐ Notice of Informal Patent Application (PTO-152)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) ____ 6) ☐ Other: _____

DETAILED ACTION

Election/Restrictions

1. Applicant's election with traverse of claims 2-7 in Paper No. 4 is acknowledged. The traversal is on the ground(s) that, see the traverse. This is not found persuasive because inventions of method group (II) and device group (I) have different classifications so the searches are non-coextensive. Further, the examiner has shown that the process of claim 6 can be materially altered by forming a nonuniformly doped n-type substrate which contains a diffused n⁺ layer on one side wherein the diffused layer, which is near to the backside p⁺ emitter into the surface of residual diffused layer, then forming the wafer from the high concentration side of the substrate by such commonly used techniques as grinding and polishing, then forming the general front side structure of either IGBT, MCT, or GTO on the low concentration side of the n-type substrate using ion implanting, high temperature diffusion. See the restriction.

The requirement is still deemed proper and is therefore made FINAL.

Claim Rejections - 35 USC § 103

2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

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3. Claims 2-7 are rejected under 35 U.S.C. 103(a) as being unpatentable over Otsuki et al. (U.S. Patent 5,378,903) in view of Bartko et al. (U.S. Patent 4,278,476) and Sopori (U.S. Patent 5,304,509).

Otsuki teaches a method for fabricating low-power-loss power semiconductor switching devices, wherein the fabrication is in the following sequence (See col. 5, line 57 to col. 6, line 33 and FIG. 1):

fabricating a nonuniformly doped n-type substrate which contains a diffused n⁺ layer 3 on one side, wherein the diffused layer, which is finally near to the backside p⁺ emitter 2, is formed in the first step of this procedure before the thinning of the substrate;

fabricating the general frontside structure of either an IGBT, MCT, or GTO;

thinning the wafer from the high-concentration side of the substrate so that the thickness of the residual diffused-layer is decreased to a required value;

forming the backside p⁺ emitter 2 with a required thickness into the surface of the residual diffused-layer 3; and

depositing metals 1 on the surface of the backside p⁺ layer;

Otsuki fails to teach fabricating the general frontside structure of either an IGBT, MCT, or GTO on the low-concentration side of the n-type substrate using ion implanting, high-temperature diffusion and wherein after PROCEDURE III or since PROCEDURE IV, only low-temperature processes occur and wherein low temperature is considered to be less than 600 °C as recited in present claims 6-7.

Bartko teaches fabricating the front side structure on the low-concentration side of the n-type substrate using ion implanting, high-temperature diffusion at about 1200 °C

(See col. 1, line 56 to col. 2, line 43) and then forming the p⁺ type impurity layer 40 in low temperature at about 600 °C (See col. 3, lines 13-37 and FIG. 7). *It would have been obvious to one of ordinary skill in the art of making semiconductor devices* to incorporate Bartko's teaching into Otsuki's method because in doing so an n-type impurity region in a n-type substrate can be formed. See col. 1, lines 19-24.

Otsuki fails to teach thinning the wafer using techniques such as grinding and polishing as recited in present claim 6. However, the use of grinding and polishing in thinning the wafer is well-known to *one of ordinary skill in the art of making semiconductor devices*.

Otsuki fails to teach depositing metals on the surface of the backside p⁺ layer, followed by sintering/alloying as recited in present claim 6.

Sopori teaches sintering/alloying the metallic coatings. See col. 4, lines 29-34. *It would have been obvious to one of ordinary skill in the art of making semiconductor devices* to incorporate Sopori's teaching into Otsuki's method to prevent the implanted hydrogen from being driven from the substrate. See col. 4, lines 29-34.

Otsuki fails to teach the thickness of the backside p⁺ emitter and the n-type residual diffused-layer, the implanting dose of the backside p⁺ emitter, and the doping concentration of the n-type residual diffused-layer as recited in present claims 2-5.

However, it would have been obvious to *one of ordinary skill in the art of making semiconductor devices* to determine the workable or optimal thickness of the backside p⁺ emitter and the n-type residual diffused-layer, the implanting dose of the backside p⁺ emitter, and the doping concentration of the n-type residual diffused-layer

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through routine experimentation and optimization to obtain optimal or desired device performance because the thickness of the backside p+ emitter and the n-type residual diffused-layer, the implanting dose of the backside p+ emitter, and the doping concentration of the n-type residual diffused-layer are result-effective variables and there is no evidence indicating that the thickness of the backside p+ emitter and the n-type residual diffused-layer, the implanting dose of the backside p+ emitter, and the doping concentration of the n-type residual diffused-layer are critical and it has been held that it is not inventive to discover the optimum or workable range of a result-effective variable within given prior art conditions by routine experimentation. See MPEP 2144.05.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Khiem D Nguyen whose telephone number is (703) 306-0210. The examiner can normally be reached on Monday-Friday (8:00 AM - 5:00 PM).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Wael Fahmy can be reached on (703) 308-4918. The fax phone numbers for the organization where this application or proceeding is assigned are (703) 746-9179 for regular communications and (703) 746-9179 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0956.



LONG PHAM
PRIMARY EXAMINER

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K.N.

September 20, 2002